

CLAIMS

1. A vehicle operation simulator comprising:
a mobile vehicle operable in a natural environment having at least one vehicle control;
5 a scene generator;
a scene display in communication with said scene generator and viewable by a vehicle operator,
an environment view being presented on said scene display which is created at least in part by said scene generator; and
10 wherein said mobile vehicle carries the operator and is controlled by the operator in accordance with said environment view, said mobile vehicle responding to actuation of said at least one vehicle control and said environment view responding to at least one of operation of said at least one vehicle control, operator movement, and vehicle movement.
- 15 2. The vehicle operation simulator of claim 1 including at least one of an inertial acceleration measurement unit, a gyroscopic measurement unit, and a pendulum, responding to motion of said mobile vehicle in up to six degrees of freedom to provide input to said scene generator.
- 20 3. The vehicle operation simulator of claim 1 including at least one of an inertial acceleration measurement unit, a gyroscopic measurement unit, and a pendulum, responding to motion of said operator's head in up to six degrees of freedom to provide input to said scene generator.
- 25 4. The vehicle operation simulator of claim 1 including a measurement unit responding to a velocity of said mobile vehicle in up to six degrees of freedom to provide input to said scene generator.

5. The vehicle operation simulator of claim 1 including at least one of a global positioning system unit and a laser triangulation unit, responding to changes in position of said mobile vehicle in up to six degrees of freedom to provide input to said scene generator.
- 5 6. The vehicle operation simulator of claim 5 including at least one of an electromagnetic arm, a mechanical arm with potentiometer, and magnetic sensors, responding to changes in position of said operator's head in relation to said mobile vehicle in up to six degrees of freedom to provide input to said scene generator.
- 10 7. The vehicle operation simulator of claim 1 including a computer-based mathematical model of activity of said vehicle, responding to at least one of said vehicle control and movement of said vehicle, to provide data on at least one of position of said vehicle in up to six degrees of freedom as input to said scene generator.
- 15 8. The vehicle operation simulator of claim 1 wherein said environment view is wholly comprised of elements from said scene generator.
9. The vehicle operation simulator of claim 8 wherein said scene display is affixed to at least one of said mobile vehicle and a head-mounted display worn by the vehicle operator.
- 20 10. The vehicle operation simulator of claim 1 wherein said environment view is a composite of at least one element from said scene generator, and at least one element from the natural environment.
- 25 11. The vehicle operation simulator of claim 10 wherein said at least one element from the natural environment is captured with a video camera and input to said scene generator.
12. The vehicle operation simulator of claim 10 wherein said at least one element from the natural environment is visible to said operator through a partially transparent viewing
- 30 screen.

13. The vehicle operation simulator of claim 12 wherein the viewing screen is affixed to at least one of the mobile vehicle and a head-mounted display worn by the vehicle operator.

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14. The vehicle operation simulator of claim 10 wherein said scene generator includes a mechanism maintaining equivalent light brightness between at least one element from said scene display and the natural environment.

10 15. The vehicle operation simulator of claim 1 wherein the at least one element presented in said environment view differ in a controlled fashion from the actual behavior of said mobile vehicle.

15 16. The vehicle operation simulator of claim 15 wherein the vehicle responds to operator actuation of vehicle control in accordance with movement represented in said environment view rather than the movement of said vehicle.

20 17. The vehicle operation simulator of claim 1 including one or more sensors responding to movement of said operator within said mobile vehicle to provide input to said scene generator and said scene display.

18. The vehicle operation simulator of claim 1 including secondary vehicle control for said mobile vehicle, said secondary vehicle control to be actuated by a second operator.

25 19. The vehicle operation simulator of claim 18 wherein said mobile vehicle responds exclusively to said secondary vehicle control when said secondary vehicle control is actuated.

20. The vehicle operation simulator of claim 18 wherein said mobile vehicle selectively responds to both said secondary vehicle control and said vehicle control when said secondary vehicle control is actuated.

5 21. The vehicle operation simulator of claim 1 including parameter-constraining apparatus limiting at least one of the movement of said mobile vehicle and the actuation of said vehicle control.

10 22. The vehicle operation simulator of claim 1 wherein said scene display includes at least one of a mirror, a flat opaque viewing screen, a curved opaque viewing screen, and electronic display, and a partially transparent half-silvered mirror.

23. A method for simulated operation of a vehicle in a natural environment including the steps:

- 15 (a) generating an environment view;
- (b) presenting the environment view to an operator carried by a mobile vehicle, said mobile vehicle operating in a natural environment;
- (c) the operator actuating controls for said mobile vehicle, movement of said mobile vehicle responding to said actuation; and
- 20 (d) altering said environment view in response to at least one of vehicle movement, operator actuation of controls, operator head movement, and operator movement within said vehicle.

24. The method of claim 23 wherein the elements presented in said environment view
25 differ in a controlled fashion from those commensurate with the actual behavior of said mobile vehicle.

25. The method of claim 23 wherein said environment view comprises at least one element rendered by said scene generator and at least one element from the natural
30 environment.

26. The method of claim 25 wherein step (a) includes maintaining equivalent light brightness between at least one element from said scene display and the natural environment.

5 27. The method of claim 23 wherein said environment view is wholly comprised of elements from said scene generator.

28. The method of claim 23 wherein said vehicle has secondary vehicle control, and including the step of said secondary vehicle control being actuated by a second operator
10 under selected conditions.

29. The method of claim 28 wherein said mobile vehicle responds exclusively to said secondary vehicle control when said secondary vehicle control is actuated.

15 30. The method of claim 28 wherein said mobile vehicle selectively responds to both said secondary vehicle control and said vehicle control when said secondary vehicle control is actuated.

31. The method of claim 23 wherein said environment view is presented on at least one
20 of a scene display affixed to said mobile vehicle and a head-mounted display worn by the vehicle operator.

32. The method of claim 23 wherein step (c) includes limiting at least one of the movement of said mobile vehicle and actuation of said vehicle control.